

PUBLIC TRANSPORTATION TRAINING: IN VIVO VERSUS CLASSROOM INSTRUCTION

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This study evaluated a classroom program to teach public transportation usage (bus-riding skills) to retarded persons. Based on a task analysis of specific skills, five retarded male students were taught each of the components of locating, signalling, boarding and riding, and exiting a bus. These skills were taught sequentially, using training procedures consisting of role playing, manipulating the actions of a doll on a simulated model, and responding to questions about slide sequences. Before, during, and after training, subjects were tested on generalization probes in the classroom and in the natural environment. Results of a multiple-baseline design across subjects indicated that up to 12 months after termination of training, each subject exhibited appropriate bus-riding skills on actual city buses. Two other subjects were trained on each skill component *in vivo*, on city buses, in order to compare the relative effectiveness and efficiency of classroom *versus in vivo* training. Both of these subjects acquired appropriate bus-riding skills; however, the *in vivo* training procedure was both more time consuming and expensive than classroom training. These findings further demonstrate the effectiveness and practicality of properly designed classroom training procedures for teaching community survival skills to retarded persons.

DESCRIPTORS: bus riding, community survival skills, cost comparison, generalization, simulator training, task analysis, retardates

A current national emphasis in the fields of both mental health and education toward integrating institutionalized, retarded, and other handicapped persons into the mainstream of community life has highlighted a critical need for the development of viable models for programming in the area of independent living skills. Very little research, however, has empirically evaluated programs designed to teach or maintain such skills. Thus, it is not surprising to

find data revealing that many handicapped persons placed in community group living homes (*e.g.*, half-way houses) and foster homes do not exhibit those behaviors that are prerequisites to community survival (Perske and Marquiss, 1973).

Recent research in the area of community programming has emphasized such skills as: telephone dialing (Leff, 1974, 1975), general housekeeping (Bauman and Iwata, 1977), leisure-time activities (Johnson and Bailey, 1977), and coin usage (Lowe and Cuvo, 1976; Trace, Cuvo, and Criswell, 1977). Another area of particular concern has been the problem of community mobility. Travel skills are essential for independent functioning; however, the potential hazards that naturally exist in the community pose a real danger to the safety of the handicapped person and may seriously curtail access to a wide range of educational, vocational and recreational opportunities (Nihira

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and Nihira, 1975a, b). Accordingly, the President's Committee on Mental Retardation (1972) recommended that all agencies and schools providing services to retarded persons develop programs specifically to teach travel skills: street crossing (pedestrian skills), public transportation usage, and driver training. The results of a questionnaire conducted by the Committee revealed that many parents had been driving their children to various programs for 15 yr or more and those who did not drive were forced to rely on parents and friends for transportation for their mentally retarded children.

Although others (Eagan, 1967; Egg, 1965) have also discussed the importance of transportation training, and have presented several general programs for instruction (Cortazzo, 1971; Laus, 1977; Lupei, 1975), few studies have reported the systematic evaluation of procedures aimed at training any type of community mobility skills. Jackson, Mayville, and Cowart (1972) and Yeaton and Bailey (1978) both taught normal children to cross streets appropriately on their way either to or from school, using instruction and/or reinforcement procedures directly in the natural environment. Page, Iwata, and Neef (1976), on the other hand, attempted to teach generalized pedestrian skills using a combination of role playing, modelling, and reinforcement and corrective feedback on a classroom simulated model. Probe data taken under actual traffic conditions showed that the classroom-trained skills generalized to the natural environment and that they maintained during a followup period lasting from two to six weeks. In a recent study aimed at teaching public transportation usage, Certo, Schwartz, and Brown (1977) utilized a combination of both classroom and natural environment (*in vivo*) instructional procedures.

To the extent that classroom instruction alone produces generalized skill acquisition, Page *et al.* (1976) suggested several advantages of such an approach over *in vivo* instruction, including the initial reduction of potentially embarrassing and even dangerous situations,

and savings in terms of training time and costs. As an extension of that research, the present study was designed to develop and evaluate a classroom program to teach public transportation usage to retarded persons. In addition to providing a systematic replication of the general procedures used by Page *et al.* with a more complex behavioral repertoire, the present research refined several aspects of that study. First, in order to ensure continued safety of students in the previous program, a trained monitor was always stationed at corners that the students would be crossing. In the present study, all participants had already demonstrated mastery of pedestrian skills, making it possible to position an observer unknown to the students on the bus in order to collect covert probe performance data. Second, all probes in the Page *et al.* program were conducted at the same intersections. In the present study, a followup probe was conducted on a novel bus route and location to assess further generalization. Third, the present study utilized a much longer followup period (up to 12 months) than did the earlier study (less than two months). Finally, whereas Page *et al.* did not provide any comparison between classroom and *in vivo* instruction to determine which procedure was in fact more effective or efficient, the present study incorporated a between-subject comparison of the two procedures in terms of acquisition time and training costs associated with the programs.

METHOD

Subjects

Five students enrolled at the Kalamazoo Valley Multihandicap Center, a program for the physically handicapped and mentally retarded, served as subjects for classroom training. All were ambulatory, with ages ranging from 18 to 24 yr (mean = 20 yr), and IQ scores ranging from 46 to 85 (mean = 56). The students spent half of each school day receiving academic instruction, and the other half in a prevocational workshop. Subjects were chosen on the basis of

(1) willingness to participate and the granting of parental permission, and (2) ability of students to exhibit appropriate pedestrian behaviors as defined by Page *et al.* (1976). None of the subjects had previous experience with riding city buses, although all had a history of riding school buses.

Setting and Apparatus

Classroom. Training sessions, review sessions, and classroom generalization probes were conducted in a KVMC classroom located in downtown Kalamazoo. The following apparatus was used:

Model—The same model used to teach pedestrian skills (Page *et al.*, 1976) was utilized. Constructed on a 81.3- by 101.6-cm poster-board, it simulated four square city blocks, and contained cardboard buildings, trees, people, stop sign, and traffic light. In addition, a 5.1-cm tall bus stop sign and two 5.1-cm long toy buses could be placed anywhere on the model or removed altogether. A 7-cm hard rubber doll with movable arms was also used for manipulation by the subjects.

Slides—Photographic stimuli presented during trials were chosen from a pool of 40 slides consisting of both instances and noninstances of appropriate discriminative stimuli for the skills being taught. A carousel slide projector was used to display the slides on a wall of the classroom.

Bus—A simulated bus was used consisting of a 1-m tall cardboard coin meter, eight chairs, a black 2-m cord taped to the wall, extending within arms reach above the chairs. Appropriate locations were designated as front door, back door, and front window. Slides were projected on the wall directly in front of the chairs, which was designated as the front window. The slides showed sequenced locations along a city bus route, taken through the front window of a bus on its actual route.

City environment. Generalization probes were conducted before, during, and after train-

ing at, or within two blocks of a bus stop, and on an actual city bus during an hourly 10-mile route.

Procedure

Task sequence and response definitions. Figure 1 shows a flow-chart analysis of appropriate bus-riding behavior. For example, a subject should begin by walking to a bus stop. Once at the bus stop, the subject should determine whether the appropriate bus is waiting. If not, the subject should wait near the bus stop, away from the curb. If the correct bus is present, the subject should determine whether there is a line or passengers exiting before boarding the bus, and so on throughout the entire sequence. A component analysis of bus riding, based on the behaviors identified in Figure 1, yielded four major skills. The first was bus-stop location, and consisted of walking directly to an appropriate bus-stop sign. The second was bus-boarding skills, and included behaviors appropriate to boarding and riding a city bus. The third consisted of skills necessary for exiting a bus at a designated location. The fourth applied to skills used while waiting for and signalling an approaching bus.

Table 1 describes each target behavior. Specific components of each of the four skills are presented under the heading "Correct Response". Also shown are the operational definitions of incorrect responses used throughout the study.

Classroom training procedure. Instructional procedures were carried out by the authors, and involved teaching the four skills in order, beginning with bus-stop location, using three different techniques. These were: (1) training on the model, (2) requiring verbal responses to questions about slide sequences, and (3) role playing. Table 2 describes how each procedure was employed, the order of sequencing for the training of each skill component, and the order of presentation during classroom probes. This training sequence was used for all subjects.

Table 1
Correct and Incorrect Response Definitions for the Four Components of Bus Riding

<i>Situation</i>	<i>Correct Response</i>	<i>Incorrect Response</i>
1. Bus-stop location	1.1 Subject (S) walks directly to within 3 m of correct bus stop within 2 min of instruction.	(1) S is not within 3 m of correct bus stop within 2 min of instruction.
2. Boarding bus	2.1 S walks onto "West Main" bus before it departs.	(1) S walks onto other than "West Main" bus. (2) S does not board "West Main" bus before it departs.
	2.2 S puts 25¢ in meter or gives bus driver pass and waits for bus pass to be returned.	(1) S does not put 25¢ in meter. (2) S does not give pass to driver or wait for its return.
	2.3 S sits in any empty seat at or in front of back doors.*	(1) S sits in seat in back of back door. (2) S attempts to sit in a non-empty seat.
	2.4 S sits quietly on bus without disrupting others.	(1) S emits inappropriate verbal behavior in a manner to disrupt others or draw attention to himself. (2) S exhibits inappropriate motor behavior in a manner to disrupt others or draw attention to himself (<i>e.g.</i> , rocking, smoking, staring, arms over front seat, not facing forward, <i>etc.</i>)
	2.5 S remains seated entire time bus is in motion until bus is ½ block from Maple Hill Hall.	(1) S gets out of seat while bus is in motion. (2) S gets out of seat when bus is stopped at location other than Maple Hill Hall.

During all three training procedures, correct responses were followed by social reinforcement in the form of descriptive praise. Incorrect responses were followed by explicit feedback as to why a response was inappropriate. A remedial trial was then initiated in which the subject was asked to respond to the instruction a second time. Following an incorrect response on a remedial trial, the trainer modelled the correct response (or series of responses for an entire component when appropriate), and the subject was asked to try again. Each subsequent incorrect response was followed by the trainer modelling the correct response. Correct responses on remedial trials were reinforced, and the next training trial was then initiated.

Model training—The trainer and subject were seated at the table on which the model was placed. The subject manipulated the doll, following instructions from the trainer. A trial was initiated when the trainer instructed the subject that the doll was to ride the bus. For example, when bus-stop location was taught, after placing the doll two blocks away from a bus stop, the trainer instructed the subject to have the doll take the bus to a specific store. In this case, a correct response was recorded only if the subject moved the doll to within 5 cm of the bus-stop sign. When training on a skill with more than one component (*e.g.*, waiting for and signalling the bus), a trial involved emission of all specified components, all of

Table 1 *continued*

<i>Situation</i>	<i>Correct Response</i>	<i>Incorrect Response</i>
3. Exiting bus	<p>3.1 S pulls cord once, for 2 sec or less at location between Wards and Singers.</p> <p>3.2 S stands up within 3 sec after bus stops.</p> <p>3.3 S gets off bus within 7 sec after standing up.</p> <p>3.4 S steps on curb with no physical contact with bus within 3 sec after stepping off.</p>	<p>(1) S does not pull cord.</p> <p>(2) S pulls cord more than once.</p> <p>(3) S pulls cord for more than 2 sec.</p> <p>(4) S pulls cord when bus is 25 feet closer or further than target location.</p> <p>(1) S stands up later than 3 sec after bus stops.</p> <p>(1) S does not get off bus within 7 sec after standing up.</p> <p>(1) S is in physical contact with bus within 3 sec after exiting.</p> <p>(2) S is standing in street within 3 sec after exiting.</p>
4. Signalling bus**	<p>4.1 S stands at least 0.6 m from curb, within 3 m of bus stop, facing street.</p> <p>4.2 S raises hand when "Vine Lake" bus approaches from ½ block away.</p> <p>4.3 S stays at least 0.6 m from curb until bus comes to complete stop.</p>	<p>(1) S stands closer than 0.6 m from curb.</p> <p>(2) S stands further than 3 m from bus stop.</p> <p>(3) S does not face street (within 90° of direction from which bus approaches).</p> <p>(1) S does not raise hand when "Vine Lake" bus approaches.</p> <p>(1) S moves closer than 0.6 m from curb before bus is completely stopped.</p>

*It was considered desirable for subjects to be in close proximity to the driver in the event of emergency situations.

**Since the first skill component involved boarding a bus already waiting at a central downtown location, signalling the bus was necessary only on the return trip and thus constituted the last skill component.

which were required for the response to be considered correct.

Subjects were required to verbalize the actions of the doll while manipulating it. For example, a subject being trained on bus-stop location skills would, after receiving an instruction, grasp the doll, walk the doll to the bus stop, and say: "He's going to a bus stop to wait for the bus."

Slide sequence—For each trial, the trainer presented five slides representing examples of correct and incorrect controlling stimuli or behaviors for the component being trained. For example, in training bus-stop location, the trainer would present a slide of a street with a bus stop either present or absent, and ask the

subject "Is this the way you would walk to take the bus?" In addition to replying "Yes" in the presence of a bus stop and "No" in its absence, subjects were required to verbalize why the response was affirmative or negative. For example, a subject being trained on bus-stop location would, after being presented with a slide of a street with no bus stop present, say: "No, you would not walk this way to take the bus because there is no bus stop."

Role playing—The trainer led the subject to the simulated bus, gave him either 25¢ or a bus pass, and presented the following instructions: "This is a pretend bus. These chairs [trainer points] are the seats on the bus. This is the front window, here is the front door,

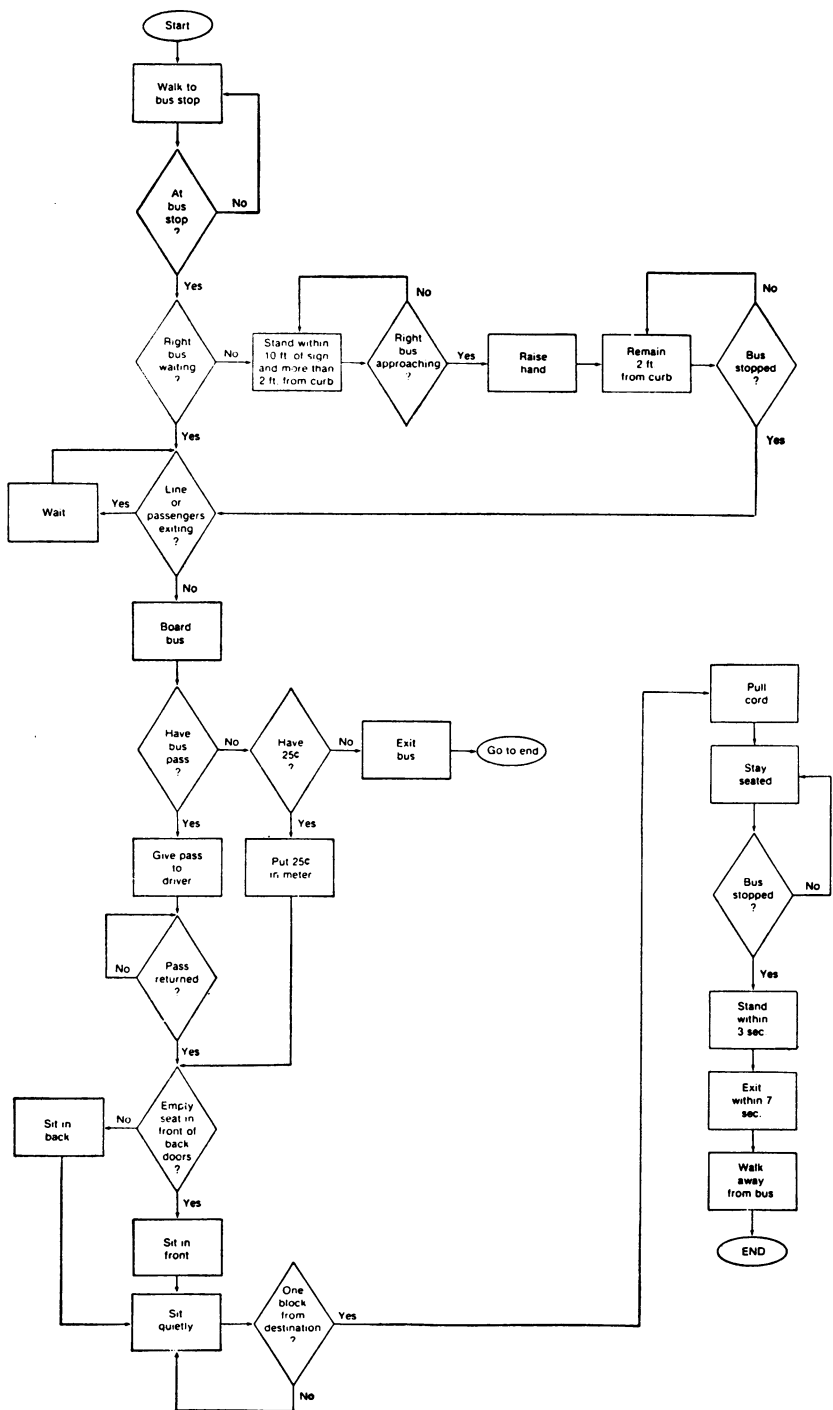


Fig. 1. Flowchart analysis of bus-riding skills. Rectangles represent responses to be performed; diamonds represent decision points in the sequence.

and here is the back door. I am the driver and I will be sitting here. I want you to take this pretend bus to the front entrance of the Maple Hill Mall." The subject was asked specific questions to determine whether he understood the instructions (e.g., "Where are you taking the

Table 2
Type of Training Procedure Used and Description for Each Skill

<i>Skill</i>	<i>Type of Training</i>	<i>Description</i>
1.1	Model	Doll placed on model and <i>S</i> instructed to have doll take bus.
1.1	Slide Sequences	<i>S</i> shown five slides and asked whether slides depict appropriate route to bus-stop location.
2.1	Slide Sequences	<i>S</i> shown five slides and asked whether bus shown in each is appropriate to take to target location.
2.2	Slide Sequences	<i>S</i> shown five slides of persons paying as they board bus, and asked what persons are doing.
2.3	Slide Sequences	<i>S</i> shown five slides of bus riders and asked if riders are sitting in appropriate seat.
2.4	Slide Sequences	<i>S</i> shown five slides of bus riders and asked if riders are behaving appropriately.
2.2	Role Playing	<i>S</i> required to pay driver upon boarding simulated bus.
2.3	Role Playing	<i>S</i> required to set in front of back doors on simulated bus.
2.4	Role Playing	<i>S</i> required to emit appropriate behaviors while sitting in simulated bus.
2.5	(a) Role Playing (b) Role Playing	<i>S</i> required to remain seated until indicated simulated bus had stopped. When asked, "When is the only time you should leave your seat?" <i>S</i> responds, "When the bus is stopped."
3.1	Role Playing	<i>S</i> required to pull cord on simulated bus when appropriate slide shown on wall.
3.2	Role Playing	<i>S</i> required to stand up within 3 sec after it was indicated that simulated bus had stopped at appropriate location.
3.3	Role Playing	<i>S</i> required to exit the simulated bus within 7 sec after standing up.
3.4	Role Playing	<i>S</i> required to walk away from simulated bus upon exiting.
4.1	Model	<i>S</i> places doll on model away from curb, near bus stop, facing street.
4.2	Model	<i>S</i> raises doll's hand when toy bus approaches from ½ block away on model.
4.3	Model	<i>S</i> does not move doll toward curb on model until bus comes to complete stop.
4.1	Slide Sequence	<i>S</i> shown five slides of person waiting for bus and asked if person is standing appropriately in each.
4.2	Slide Sequence	<i>S</i> shown five slides of persons waiting for bus as bus approaches, and asked whether bus will stop for each person.
4.3	Slide Sequence	<i>S</i> shown five slides of person waiting for bus as bus approaches, and asked if person is standing appropriately in each.

bus?"). The subject was then required to exhibit appropriate behaviors for the particular subcomponent for that skill. For example, the subject would, after boarding the bus, be required to put 25¢ in the meter or give the trainer a bus pass and wait for it to be returned in order for the response to be considered correct.

Each training session consisted of at least five trials (five trials for each of the training procedures used), not counting remedial trials. During any given session, only one subcomponent of the four bus-riding skills was taught. Criterion for mastery of a subcomponent was 100% correct responses over two consecutive training sessions. When a subject met criterion on a subcomponent, training was immediately initiated on the next subcomponent. Whenever a subject reached criterion on the last subcomponent in the chain (and thus on the entire component or skill), a review session was held, and a classroom and bus probe conducted.

Review sessions. Review sessions were conducted before each classroom probe. The purpose of these was to provide practice on all previously learned skills. Two trials were presented for each previously learned component. All conditions were identical to those of training sessions, including instructions, reinforcement, feedback, and remediation.

Classroom probes. Probes were conducted in the training environment whenever a subject reached criterion on a skill, immediately following a review session. Subjects were instructed to respond on trials involving the entire sequence of bus-riding behaviors. Thus, each classroom probe consisted of one response to each of the 21 training components shown in Table 2. Instructions given to the subjects were identical to those used during training trials. Reinforcement, corrective feedback, and remediation were not in effect, however.

Bus probes. When a subject reached criterion on a skill, and a review session and classroom probe were completed, a generalization probe was conducted in the natural environment. Data were collected at city bus stops, as well as on

buses, under natural conditions. Bus probes were similar to classroom probes, in that subjects were instructed to respond to all 21 responses over the entire sequence of bus-riding behavior. Neither reinforcement nor corrective feedback procedures were in effect. The definitions of correct and incorrect responses used to score performance on bus probes are those shown in Table 1; in addition, components 2.2 to 4.3 were retested on a return trip. Before a probe was initiated, subjects were told that they would be followed to determine how well they could ride the bus, to do the best they could, and that they would receive no clues as to what to do, other than the initial instructions. Probes were initiated at least two blocks from a bus stop, on instruction from the trainer to take the bus to a specific location. Once the subject had reached the target location, he was instructed to take the bus back to the classroom. The trainer followed approximately 3 m behind the subject and recorded the subject's behavior according to the definitions shown in Table 1. Any interaction with the trainer initiated by the subject was ignored.

During the initial probe for each subject (before training), correct responses were prompted, if absolutely necessary, *i.e.*, if failure to emit a response would preclude testing of subsequent responses in the chain. Prompting was minimized to whatever was necessary to allow testing of a subsequent response. For example, if the subject did not walk to a bus stop when the probe was initiated, he was told, following an incorrect response, to follow the trainer, whereupon he was led to the bus. Data were then collected on the remaining behaviors in the sequence.

No responses were prompted during subsequent probe sessions. During these unprompted probes, if a response did not occur, thus precluding the occurrence of subsequent responses in the sequence, all responses not emitted were scored as incorrect. For example, if a subject did not walk to a bus stop following the initial instruction, and as a result did not ride the bus,

all responses were recorded as incorrect, and the subject was taken back to the classroom. Subjects who did not exhibit a skill immediately after receiving training on that skill underwent an additional review session and probe before proceeding to instruction on the next skill.

Followup probes. Following completion of training on the fourth and last skill, followup probes were conducted to assess the degree of maintenance of the behavior trained. An experimenter sent a subject on an errand that would require riding a bus to and from the location where subjects were sent on previous probes. An observer who was unfamiliar to the subject was positioned on the appropriate bus before the subject boarded it. The observer both recorded the subject's responses and was available to provide assistance in the event of possible danger to the subject (there were never any instances of observer intervention during the probes). A minimum of three checks were obtained for each subject over a one- to 12-month period.

After collection of posttraining data described above, additional probe data were collected on a different bus route than that used during baseline, training, and followup. Subjects were instructed to take a specific bus to a McDonald's restaurant (located on the opposite side of town from the first probe site), where they were being assessed for restauranting skills. One probe was given for each subject in the restauranting program, and scoring of correct and incorrect responses was identical to that used previously.

In vivo training. Two students from the same class as the original five subjects and having similar backgrounds and abilities (mean IQ = 53), were taught bus riding using an *in vivo* procedure. One of the subjects had previously mastered the pedestrian skills training program, while the other subject had considerable experience in crossing streets and needed no further instruction in this area. All training for bus riding was conducted in the natural environment, either at bus-stop locations or on the same city bus used in probing the classroom trained

subjects. Each session involved a subject and trainer riding the bus on its daily route. The trainer followed behind the subject and delivered descriptive praise contingent on correct responses. When an incorrect response occurred, the trainer provided explicit verbal feedback and, when possible, modelled and prompted a correct response. For example, after observing a subject incorrectly waiting for a bus during training on bus signalling, the trainer might say: "You're standing near the bus stop and away from the street. That's great! But you're facing in the wrong direction. You should face the street so that you can see when the bus comes." If the subject continued to wait incorrectly, the trainer would model the correct response, and have the subject observe and then imitate it. In situations where such modelling and prompting were impractical due to temporal restrictions, the trainer used whatever means were available for remediation. For example, when training a student on how to exit a bus, the trainer would observe whether or not the subject was attending to the fact that the bus was approaching the target location, and if the subject was preparing to pull the cord. If there was no indication that the subject was going to emit the appropriate response, the trainer would say: "We want to get off the bus here. What should you do? That's right, pull the cord." After exiting the bus, the trainer would re-emphasize the importance of watching for the target destination, and the relationship of pulling the cord and stopping the bus.

Reliability. Independent observations were made during training trials and classroom and bus probes by either one of the experimenters or a graduate student naive to the experimental conditions. Following data collection, trainer and observer records were compared and inter-observer reliabilities were calculated by dividing the number of agreements by agreements plus disagreements, and multiplying by 100. An agreement was scored if both observers recorded the same behavior as either occurring or not. This formula was used to compute agreement

percentages for: (1) occurrences of correct responses, (2) nonoccurrences of correct responses, and (3) occurrences plus nonoccurrences.

Reliability checks made on 5% of all training sessions yielded 100% agreements for all three indices. Checks on 50% of all classroom probes yielded mean scores of 95%, 92%, and 96% for occurrences, nonoccurrences, and occurrences plus nonoccurrences, respectively. Checks made on 62% of all bus probes yielded means of 98%, 96%, and 99%.

Experimental Design

The design was a multiple baseline across subjects (Baer, Wolf, and Risley, 1968). Baseline data consisted of one prompted and one unprompted bus probe and a minimum of five classroom probes for each subject before training in the four skill areas. Training was begun with the first subject on bus-stop location, and proceeded sequentially through the other four areas. Baseline probes consisting of classroom and unprompted bus probes continued for all skills not yet trained. When the first subject met criterion for bus-stop location and advanced to bus-boarding skills, the second subject began training on bus-stop location, and so on. Baseline probes continued for all subjects not yet receiving training.

RESULTS

Shown in Figure 2 is the performance on classroom (open circles) and bus (closed circles) probes across consecutive probe sessions for each of the five subjects who received classroom training. The number of correct responses of a possible 21 is shown for probes conducted during baseline, training, and followup conditions. Scores on the initial prompted bus probe (closed triangles) ranged from eight for Subject 1 to 14 for Subjects 2 and 5. Scores on classroom probes were 10 or less for all but Subjects 2 and 4. Scores on unprompted bus probes taken immediately before training were 4, 15, 7, 6, and 13 for Subjects 1 to 5, respectively.

As can be seen in Figure 2, subjects' scores

on both classroom and bus probes improved as they were exposed to sequential training on the four major skills. Scores on both bus and classroom probes following training on the final skill were 20, 21, 21, 20, and 21 for Subjects 1 to 5 respectively.

Followup data in the form of bus probes conducted after training had been discontinued are also presented in Figure 2. Mean scores on these probes were 20.0, 20.5, 18.7, 19.3, and 19.7 for Subjects 1 to 5 respectively. Also shown are scores on generalization bus probes in which subjects rode a bus on a different route than that used during baseline, training, and followup probes. Numbers of correct responses were 18, 19, 18, and 19 for Subjects 1 to 4 respectively. (Subject 5 had moved before novel bus probe data were collected.)

Figure 3 shows similar results for the two subjects who were trained *in vivo*. Subject 6 scored five and Subject 7 scored 11 correct responses on the initial unprompted bus probe. The number of correct responses increased for both subjects after they began receiving training. Scores on the probe conducted after training on the final skill were 17 for Subject 5 and 21 for Subject 7. In addition, Subject 7 scored 19 correct on the novel bus probe. A novel bus probe was not conducted for Subject 6.

Table 3 shows a comparison of classroom and *in vivo* training in terms of training time required to complete the program, as well as costs. For subjects trained in the classroom, total training time ranged from 5.25 hr (Subject 5) to 14.25 hr (Subject 1); the mean time for all five subjects was 8.85 hr. This compared favorably with data from *in vivo* training; the two subjects on *in vivo* training required 38 and 28.5 hr of training time (mean = 33.25 hr).

The mean number of training sessions required to complete the program was also longer for *in vivo* subjects (66.4 sessions) than for those trained in the classroom (35.4 sessions).

Classroom training was also more practical than *in vivo* training on the basis of total cost. Training costs for the classroom procedure av-

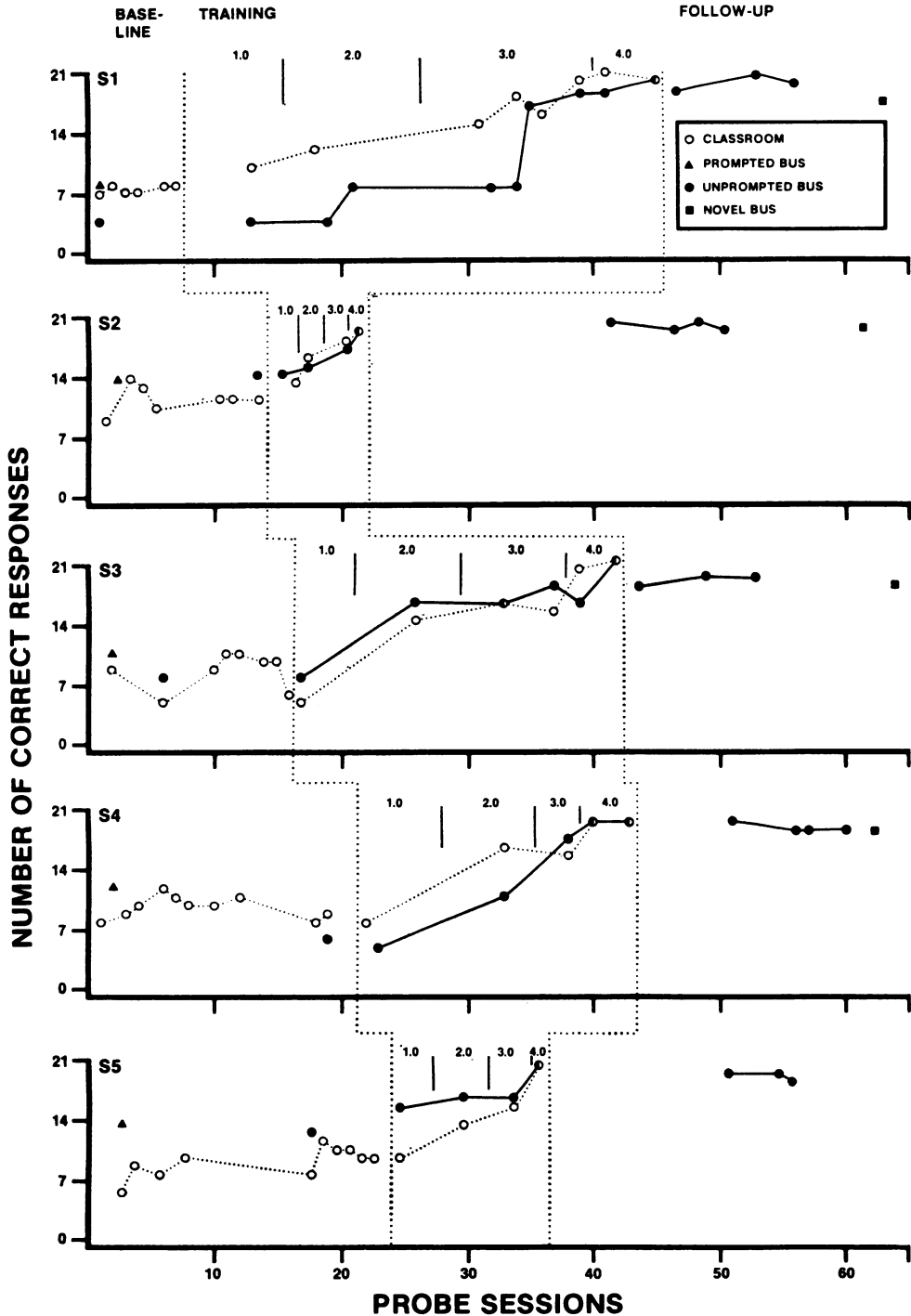


Fig. 2. Number of correct responses on classroom and bus probes for the five classroom trained subjects during baseline, training, and followup conditions.

eraged \$33.60 per subject. Costs consisted of used during role playing and simulator training, and materials used to build the model,

Table 3
Time/Cost Analysis of Training

	Classroom Training	In Vivo Training
TIME (hr):		
Total training time	44.25	66.5
Number of subjects trained	5	2
Mean training time per subject	8.85	33.25
COSTS:		
Trainer salary		
@ \$3.00 per hour	\$132.75	\$199.50
Labor (apparatus)		
@ \$2.50 per hour	\$20.00	N/A
Materials costs (apparatus)	\$15.24	N/A
Bus rides		
@ \$0.50 per session	N/A	\$52.50
Total cost	\$167.99	\$252.00
Number of subjects trained	5	2
Mean cost per subject	\$33.60	\$126.00

trainer salary, and labor costs for the apparatus. Costs for training subjects *in vivo* averaged \$126.00, based on trainer salary and subject and trainer bus fares of 50¢ each per training sessions, with each session consisting of a round-trip bus ride.

DISCUSSION

In support of the findings of Page *et al.* (1976), these results indicate that bus-riding skills taught to retarded persons in a classroom setting may be generalized to the natural environment. The collective results of these studies are most likely due to the fact that the simulation procedures required responses to critical stimuli that were very similar to those found in the natural environment. Also, training in the classroom may have had the additional effect of minimizing irrelevant and distracting features present in the natural environment.

The effectiveness of the training procedures was demonstrated by a multiple-baseline design across subjects and skill components. During baseline, correct responses typically consisted of boarding the correct bus if that bus was the first or only bus available, sitting near the front and exiting the bus downtown on

completion of the route. Probe scores increased only after training conditions were introduced, and were maintained after training terminated. Followup probes indicated that subjects demonstrated appropriate bus-riding behaviors from one week to 12 months after training.

The present results extend the findings of Page *et al.* (1976) in several respects. First, generalization of bus-riding skills from the classroom to the natural environment was demonstrated in a situation in which probes were unstructured, in that subjects were given only an initial set of instructions and observed discretely. Second, appropriate bus-riding behavior generalized to an untrained, novel route and location. The fact that the skills acquired were not situation-specific increased the utility and practicality of the procedure. Finally, classroom training was demonstrated to be more cost-effective than *in vivo* training. These results do not seem surprising because *in vivo* subjects were not able to receive remediation for errors until at least the next day. For example, *in vivo* subjects had only one opportunity to pull the cord at a given location per session, whereas it was possible to arrange classroom training such that the stimulus situation for cord pulling could be presented repeatedly within a session, and thus more practice and immediate feedback provided. In addition to the increased number of training sessions required, the training time per session was also more for *in vivo* subjects, since each bus ride took a minimum of 1 hr, whereas a conservative estimate of training time per session for classroom subjects was 15 min. Thus, considerably more than three times as many hours were required to train *in vivo* subjects as classroom subjects. Similarly, the classroom training procedure cost considerably less than *in vivo* training. *In vivo* training cost \$1.00 per training session (50¢ round trip for trainer and subject), whereas the initial cost of materials (\$15.24) for classroom training constituted a one-time investment for training a large number of subjects.

Although the present data indicate that the

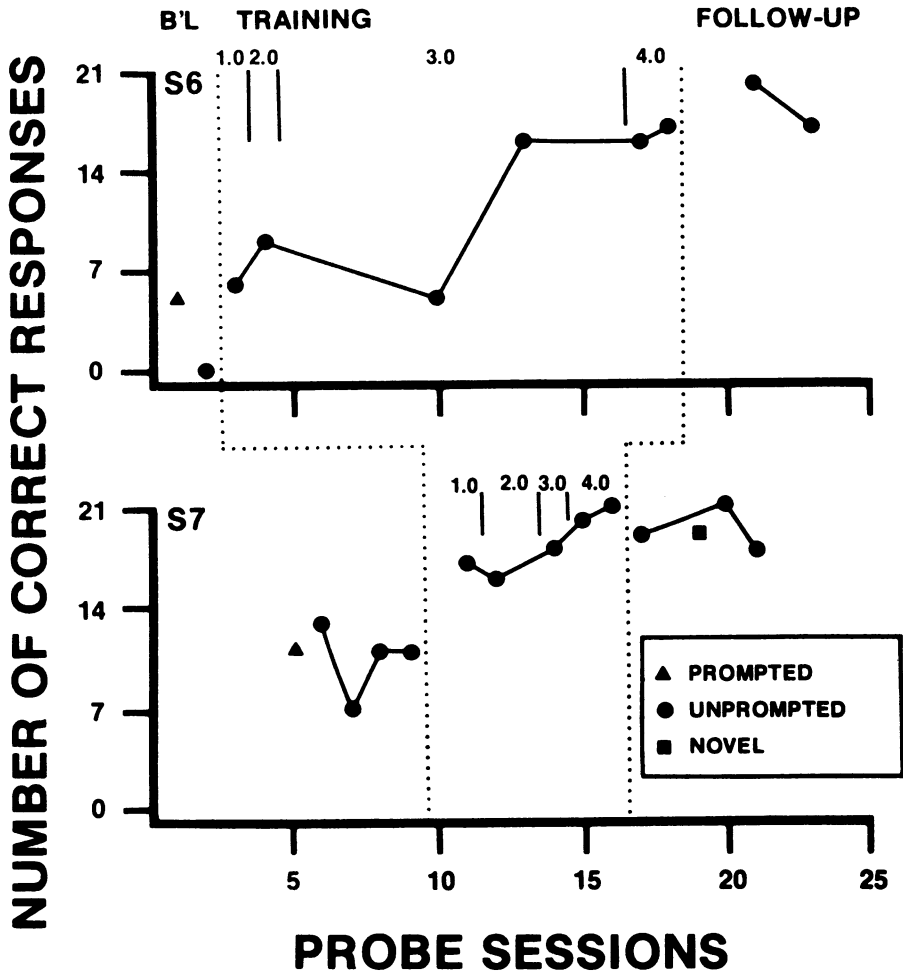


Fig. 3. Number of correct responses on bus probes for the two subjects trained *in vivo* during baseline, training, and followup conditions.

classroom and *in vivo* procedures were equally effective in teaching public transportation usage, and that classroom instruction was more cost-effective, these results should be interpreted with caution. First, the present study utilized a between-subject comparison in which a small number of subjects was exposed to the *in vivo* procedure. Second, since all subjects in the present study had been trained to use appropriate pedestrian skills with the Page *et al.* (1976) procedure, subjects' previous exposure to the model and its associated training procedures may have facilitated transfer of training effects to bus-riding instruction. Third, although none of the subjects had ridden public buses before

the study, all had previous experience riding school buses. Thus, it is possible that at least some prior exposure to any type of actual bus-riding situation is necessary for generalization to occur from a classroom training situation to the natural environment. A final consideration is that the *in vivo* instruction could have been conducted more efficiently; for example, by training more than one skill component at a time. However, such a possibility seems unlikely, since subjects demonstrated considerable difficulty acquiring skill components when taught one at a time. Thus, increasing the complexity of the task would not be expected to facilitate performance.

In summary, the present study demonstrated both an effective and economical approach to teaching public transportation usage to retarded, and conceivably normal, student populations. The classroom procedure represents an attractive alternative to instruction in the natural environment in which the time, cost, and potential risks may be prohibitive to the extent that school and institutional administrators may be hesitant to provide training. Administrator and parental concern regarding student safety could be further allayed by teaching students what to do in situations where they become lost. In addition, the present program can be expanded to teach students how to call the bus company for information regarding different bus routes, schedules, and so on.

Future research is needed in training retarded persons to engage in those behaviors that become accessible through increased mobility. Although the present study demonstrated that students exhibited bus-riding skills for as much as 1 yr following training, it is doubtful that public transportation usage would be maintained over time unless other behaviors are available to reinforce the use of mobility skills. Research is underway on a program for teaching restaurant usage to the subjects in this study. Retarded persons must be taught additional skills, such as shopping or library usage, so that community mobility becomes a truly functional skill.

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